

**Comprehensive Final Report
ISDA Nursery, Landscape, and Florists Grant Program**

**Improvement, Propagation, and Commercialization of Native Plants for
Water-Conserving and Traditional Landscapes
NAC/ISDA 2015-2**

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As the result of current funding disputes, 2015 is likely the last year the native plant domestication project will be funded by the ISDA Nursery, Landscape, and Floral Research and Education Program. Consequently, this document will serve as comprehensive report for the 10-year lifespan of the project.

Abstract

Objective: Domesticate wild-collected, water-conserving native plants for use by the Idaho nursery industry. Activities include collection, evaluation, increase, and commercialization of Intermountain West native plants.

Historical Perspective: The University of Idaho native plant domestication project was initiated in 2005 and has been supported by the ISDA Nursery, Landscape, and Floral Research and Education Program since 2006. Over the life of the project, the ISDA has granted \$133,753 in funding support.

Accomplishments: Collection activities, with intent to provide native plant materials for evaluation, selection, and product development, was initiated in 2005 and continued through annual collection excursions to sites in Idaho and surrounding states. Additional plants materials were obtained from professional collectors, native plant societies, researchers, and private individuals. Over the life of the project, we acquired 3,360 accessions of native plants representing 1,078 species.

Native plant domestication, consisting of repetitive evaluation and selection, has been conducted at the Aberdeen R & E Center since 2006. Currently, 645 native plant accessions persist in 3 acres of evaluation plots and are being considered for product development. At the end of 2015, 199 superior native plant accessions are being grown in a one-acre seed increase block for purposes of producing seed for transfer to our Native Roots, LLC partner.

To date, approximately 110 prospective native plant products have been transferred to Native Roots, LLC for seed increase and market development activities. Eighty-nine of

these selections are still being considered for market development. Thirty-eight are awaiting establishment at the Native Roots, LLC production farm in Filer, Idaho. Sixteen are in the increase phase and awaiting a decision to move into the product pool. Thirty-five native species have been approved for marketing. Seed and plant sales of the 35 initial products began in 2012 with product sales expanding each year.

Summary: The native plant domestication project has been an extremely successful program by every measure. A new, unique, and potentially very useful pool of plant materials has been tapped. New products have been developed and infused into the Idaho nursery industry. A new company has been formed to market the resulting plants. Six nurseries are now selling plant products from this project.

Objectives

During its 10-year lifespan, this project was guided by four primary objectives:

- 1) Acquire diverse native plant germplasm with potential to become viable nursery products.
- 2) Evaluate native and adapted species under conditions of limited water availability to determine their potential contribution to attractive water-conserving landscapes.
- 3) Select and develop market-ready native trees, shrubs, and perennials.
- 4) Produce usable quantities of seed or propagules and transfer this native plant material to industry (ultimately the Native Roots, LLC partnering company) for the purpose of creating marketable products for the Idaho nursery industry.

The over-riding goal was to develop unique plant materials that will attract new consumers and help keep Idaho nurseries competitive and profitable, especially - but not limited to - nurseries specializing in the production and sale of plants for water-conserving and sustainable landscapes.

Accomplishments

Acquisition of New Plant Material:

Methods: Collection of native plant materials began in 2005, the year prior to the first successful grant submission to ISDA. That year, an extended collection excursion was completed into the Pioneer Mountains of central Idaho. Utilizing ISDA funding, successive major collection excursions have been completed into the following locations: Owyhee Mountains, Idaho (2006), Seven Devils Mountains, Idaho (2007), Bear



Stephen Love collecting grass specimens on Slate Peak in Washington's northern Cascades in 2015.

River Range, Idaho (2008), Beaverhead Mountains, Idaho and Montana (2009), Canyonlands of southern Utah (2010), Bennett Hills, Idaho (2011), Hell's Canyon, Idaho and Succor Creek, Oregon (2012), western Colorado and northeastern New Mexico (2013), and high elevation sites in Idaho, Oregon, Nevada, and Utah (2014). During the latest foray, conducted July 27 through August 5, 2015, collections were made in the Cabinet Mountains of Montana, the Scotchman Peaks in Idaho, and the northern Cascade Mountains in Washington. Over the years, as opportunities presented themselves, less intensive collection forays were completed over these same years in many regions of Idaho and surrounding Intermountain states.

In addition to personal collection efforts, we endeavored to form customer and trade relations with amateur and professional collectors from around the Intermountain Region and to acquire a diverse set of seed collections from these sources. Seed purchases were commonly made from Alpains, Western Native Seed, Northwest Native Seed, Seeds Trust, Southwestern Native Seed, Seeds of the Southwest, Planet Plants, and Rocky Mountain Rare Plants. Seed exchanges were established with the North American Rock Garden Society, American Penstemon Society, Eriogonum Society, and the Denver Botanical Garden. Additional acquisitions were obtained from federal and state researchers and from private individuals.

Results: Over the 10 years of ISDA funding, and a total of 11 years of collection activities, we have acquired 3,360 accessions of native plants representing 1,078 species. These materials formed the basis for the selection and domestication program whose endpoint is the development of native plant nursery products.

Evaluation and Selection of Native Plant Accessions:

Methods: Following seed collection, the next step in the domestication process is evaluation of initial horticultural potential of each acquired accession. Testing begins with application of typical nursery production seedling handling procedures. Seeds from the 3,360 accessions obtained since 2005 were prepared for greenhouse planting as dictated by seed pretreatment needs. As a general rule, beginning in December of each year, seeds of species requiring cold treatment were mixed with moist potting soil, placed in Ziploc bags, and stratified for one to two months at 40° F. When appropriate, seeds of some species were hot-water scarified or warm-stratified. In March and April, pretreated seeds were planted in flats and allowed to germinate in a greenhouse at the Aberdeen R&E Center. When plants were 3-4 weeks old, a maximum of 40 plants from each seed lot were teased out of flats and planted into



Smooth sumac in the native plant evaluation plots on the Aberdeen R & E Center. Photo taken October, 2015.

small pots. In late May, these pot-grown plants were transplanted to the field on the Aberdeen R&E Center. Not all accessions emerged or survived the seedling stage. In a typical year, plants from approximately half to two-thirds of acquisitions emerged and survived the seedling handling process which included establishment in the field. Observations recorded on first-year, field-established plants included greenhouse propagation success, response to field transplanting, growth rate, and potential for first-year bloom.

Horticultural performance was evaluated on accessions planted in a 3-acre field on the Aberdeen R & E Center. Since 2006, new materials were introduced annually in the spring and inferior accessions eliminated over the season through a roguing process. The plots were exposed to environmental factors designed to allow selection of adapted, drought tolerant species. The evaluation plots were located on moderately heavy silt-loam soil with high pH (8.2). Drought stress was imposed by limiting irrigation; seasonal water applications were comprised of 25 to 30% (based on evapo-transpiration) of water needed to maintain a bluegrass lawn in SE Idaho. This means that in a typical year, 6 inches of supplemental (above natural precipitation) water was applied annually to the plots over the period June to August. During the growing season, plot-by-plot and sometime plant-by-plant observations were recorded describing hardiness, soil and climate adaptation, mature appearance, flower color, bloom period, plant longevity, pest issues, and general horticultural value.

Results: Over the 10 years of evaluations, native plant species with superior adaptation and horticultural performance were incrementally accumulated and, if warranted, systematically eliminated from the evaluation plots. At the end of the 2015 growing season, the number of superior accessions retained for on-going evaluation numbered 645. These exceptional plants form a selection pool for developing new and improved native plant nursery products. A few examples of recently discovered plants with exceptional horticultural potential include:



Silver-blue foliage and groundcover habit of *Antennaria media*, the alpine pussytoes.

Rocky Mountain pussytoes (*Antennaria media*): Common above treeline in Idaho's central mountains, Rocky Mountain pussytoes is an attractive, low-growing plant that can be used as a groundcover or rock garden specimen. Its native habitat is comprised of high-elevation, rocky, dry slopes making it adaptable to low-water gardens. The plants grow only an inch or less in height

and more than a foot wide. The silver-blue leaves are essentially evergreen and attractive all year round. Short flower

spikes, only a few inches high, add interest with their white flowers and black bracts. This unusual plant can be used effectively around pathways and in front of low beds.

Trumpet gooseberry (*Ribes leptanthum*): Dense foliage, dark green leaves, and flaring habit make trumpet gooseberry a superior landscape plant. This foothills species from the southern Rocky Mountains is tough and drought tolerant, making it a good specimen for a xeric garden. Mature height is around 5 feet, with slightly greater spread. Leaves are small, but numerous and dark green. Branches are armed with sharp prickles, making this species an effective hedge plant. In the spring, light pink flowers cover the plant for about 2 weeks. Flowers are followed by black (very dark purple) berries. Birds love the berries, but they are not especially tasty to the human palate. Trumpet



Flaring form and light pink flowers of spring trumpet gooseberry (*Ribes leptanthum*).

gooseberry is effective as a larger element in any bed or border planting.



serrulatus, the yellow sundrops.

Yellow sundrops (*Calylophus serrulatus*): One of the day-flowering members of the primrose family, yellow sundrops is a very attractive xeric landscape perennial. Plants are native to dry, often sandy locations in the Great Plains and eastern Rocky Mountains. Plants form dense, spherical mounds to about 15 inches tall. Flowers are about two inches

across and bright yellow. New buds form continuously and flowers are present from late spring to early fall. This is a tough, drought tolerant plant that will brighten up any dry bed or border and will be especially effective in harsh planting strips bordering hardscapes.

Peeble's starflower (*Amsonia peeblesii*): Although herbaceous, dying back to a thick crown in the winter, Peeble's starflower mimics a small shrub during the summer season. In its natural habitat, this plant grows in dry, rocky sites in the central Rocky Mountains. It has plenty of drought tolerance to be a xeric garden plant. Fine, gray-green foliage creates an attractive loose mound. The early



Intricate white blooms of Peeble's starflower (*Amsonia peeblesii*).

summer are small, white to light blue, and shaped like stars. Although slow to establish and flower, this long-lived gem is worth the wait.



Dwarf habit of the Rocky Mountain goldenrod (*Solidago multiradiata*).

Rocky Mountain goldenrod (*Solidago multiradiata*): A very dwarf cousin to the more common Canada goldenrod, this species displays typical bright sunny flowers but also combines earlier bloom and diminutive size. Native to the alpine habitats of much of the Rocky Mountains, this little plant is remarkably adapted to the hotter climates of the valleys. Mature plants are usually less than a foot tall. Leaves are dark green, attractive, and somewhat leathery. In late spring and early summer, bright yellow flowers cover the plants. The flowers are followed by white puffball seedheads. Short

rhizomes result in slow but inevitable spread causing the development of small colonies. This is a great little plant to use in complementing taller species in any xeric bed or border.

Dwarf false indigo (*Amorpha nana*): A truly dwarf shrub, this is an intriguing little plant that can provide permanent interest in a xeric garden. Native to the eastern Rocky Mountains and adjacent Great Plains, this species inhabits dry, often sandy sites and is very drought tolerant. At maturity, plants are less than 18 inches tall. Foliage, consisting in part of locust-like leaves, form a loose, symmetrical mound. In early summer tight, bright red flower spikes emerge from the foliage and provide a show for several weeks. Dwarf false indigo serves a special function in the sustainable garden given its ability to fix atmospheric nitrogen and help maintain a fertile site for itself and neighboring plants.



Bright red flaring flower spikes of dwarf false indigo (*Amorpha nana*).

Selection of Superior Plant Lines:

During the initial evaluation, one of the factors assessed is plant-to-plant uniformity within an accession. If an accession is reasonably uniform, seed is collected and the species is established in seed increase blocks. If non-uniform, the inferior plants are rogued from the population and the seed is collected from the superior plants. The seed is used to replant the line for a second round of evaluation and selection. This process is repeated as needed up to four times. Ultimately, seed is collected from the best plants within the improved line and the species is transferred into seed increase blocks. This mass selection procedure, developed early in the life of the project, is the backbone of the domestication process.

Breeder Seed Production

Beginning in 2009, seeds from the best native plant accessions and lines were collected and used to produce plants for establishment in breeder seed blocks. The intent was to provide a seed source for commercialization activities. As of 2015, seed blocks of 199 potential native plant products have been planted in the seed blocks. Seed collections have been made and seed distributed or stored from the majority of the breeder block species.



Public Evaluation of Advanced Accessions:

Methods: An extension of the evaluation process involves the creation of native plant demonstration and evaluation

gardens. Collaborators working with public and private gardens have been recruited since 2008 to assist with this process. The purpose of these demonstration gardens is to provide additional plant performance assessments in multiple soils/climates and to provide public exposure to the plants and the project. Evaluation sites have included botanical gardens, arboreta, schools, and private gardens.

Arrowleaf buckwheat planted in seed increase blocks at the Aberdeen R & E Center.



government offices, and parks. Active, well-maintained gardens are currently viewable at the Twin Falls County Extension Office, Tautphaus Park Zoo (Idaho Falls), BYU-Idaho (Rexburg), Idaho State University Life Science Museum (Pocatello), Butte County High

Planting a native plant demonstration garden at the Pocatello Charter School in 2015.

Results: As of summer 2015, demonstration gardens have been created in 32 locations around Idaho and a limited number of sites in Montana and Utah. Three of the gardens are managed by staff of public botanical gardens and arboreta, including the Idaho Botanical Garden, the Sawtooth Botanical Garden, and the University of Idaho Arboretum. Eighteen gardens have been established at public facilities such as zoos, schools, museums, golf courses, School (Arco), USDA-ARS Laboratory (Aberdeen), Montana State University Horticulture Farm

(Bozeman), and the Chesterfield Historical Park. Eleven attractive gardens have been established on visible sites in private citizen home gardens in cities such as Idaho Falls, Twin Fall, Boise, Pocatello, Rexburg, Logan (UT), and St. George (UT). All demonstration gardens have provided valuable data for making product decisions, and have created public interest in prospective native plant products that are being developed and marketed.

Commercialization and Exploitation Activities

Methods: Commercialization of new and unique native plant products began with the creation in 2011 of a partnership between the University of Idaho and Native Roots, LLC, a native plant nursery located in Kimberly, Idaho. Owners of Native Roots, LLC purchased sufficient land in Filer, Idaho to develop a commercial scale seed increase facility. Prospective native plant products were transferred to Native Roots, LLC for purposes of seed production, an important final step in product development.



Results: The first native plant products were transferred to Native Roots, LLC in the spring of 2011. Each year since, a new batch of plant products has been transferred in preparation for seed production and marketing. By the fall of 2012, the first sales of Native Roots, LLC trademarked plant products were completed. During the past 3 years, Native Roots, LLC has worked to expand partnerships with regional production, wholesale, and retail nurseries, with encouraging success. To date, the following nurseries have contracted to produce and/or sell Native Roots plant products: Living Earth, Perennial Favorites, Plants of the Wild, and Westscape Wholesale Nursery.

Blanketflower seed production block at the Native Roots, LLC farm in Filer, Idaho.

As of fall, 2015, Native Roots personnel have prepared seeds, tags, and advertising materials for 35 native plant species products (see Table 1). An additional 16 prospective plant products are in the seed production phase at the Native Roots, LLC Filer facility (see Table 2). Thirty-eight additional prospective products have been legally transferred to Native Roots, LLC in preparation for future seed production (see Table 3). Finally, 117 new and unique products are in seed production blocks at the Aberdeen R & E Center, creating a pool of prospective materials for future transfer. An effective pipeline of native plant nursery products has been created, ensuring on-going market potential. Most of the products developed to date are perennials. Some shrubs and trees, which take longer in the domestication phase, are now at or near the transfer point.

Support from the Nursery, Landscape, and Floral Research and Education Program has ensured the success of this plant unique native plant domestication project. Over the 11-

year life of the project, ISDA has contributed \$133,753 in total funding. Benefits from this project are currently being realized within the Idaho nursery industry and are expected to expand into the future.

Table 1. List of 35 native plant products currently making up the product line for Native Roots LLC, Filer, Idaho.

Common Name	Species Name		Common Name	Species Name
Cusick's hyssop	<i>Agastache cusickii</i>		Bee balm	<i>Monarda menthaefolia</i>
Threadleaf hyssop	<i>Agastache rupestris</i>		Cardinal penstemon	<i>Penstemon cardinalis</i>
Golden Columbine	<i>Aquilegia chrysantha</i>		Yellow penstemon	<i>Penstemon confertus</i>
Desert columbine	<i>Aquilegia desertorum</i>		Wasatch penstemon	<i>Penstemon cyananthus</i>
Rock columbine	<i>Aquilegia scopulorum</i>		Lowly penstemon	<i>Penstemon humilis</i>
Fringed sage	<i>Artemisia frigida</i>		Cordroot penstemon	<i>Penstemon montanus</i>
Seaside daisy	<i>Erigeron glaucus</i>		Pineleaf penstemon	<i>Penstemon pinifolius</i>
Aspen daisy	<i>Erigeron speciosus</i>		Richardson's penstemon	<i>Penstemon richardsonii</i>
Short-stem buckwheat	<i>Eriogonum brevicale</i>		Bridge's penstemon	<i>Penstemon rostriflorus</i>
Arrowleaf buckwheat	<i>Eriogonum compositum</i>		Rocky Mountain penstemon	<i>Penstemon strictus</i>
Wyeth's buckwheat	<i>Eriogonum heracleoides</i>		Whipple's penstemon	<i>Penstemon whippleanus</i>
James' Buckwheat	<i>Eriogonum jamesii</i>		Big bluegrass	<i>Poa secunda</i>
Strict buckwheat	<i>Eriogonum strictum</i>		Thurber's cinquefoil	<i>Potentilla thurberi</i>
Idaho fescue	<i>Festuca idahoensis</i>		Giant purple sage	<i>Salvia pachyphylla</i>
Blanketflower	<i>Gaillardia aristata</i>		Giant sacaton	<i>Sporobolus wrightii</i>
Ross' avens	<i>Geum rossii</i>		Hoary Townsend's daisy	<i>Townsendia incana</i>
Sundancer daisy	<i>Hymenoxys acaulis</i>		Desert zinnia	<i>Zinnia grandiflora</i>
Desert 4 o'clock	<i>Mirabilis multiflora</i>			

Table 2. List of 16 additional prospective native plant products already in the seed production phase at the Native Roots, LLC Filer, Idaho facility.

Common Name	Species Name		Common Name	Species Name
Aromatic aster	<i>Aster oblongifolius</i>		Havard's penstemon	<i>Penstemon havardii</i>
Desert fernbush	<i>Chamaebatiaria millefolium</i>		Lyal's beardtongue	<i>Penstemon lyallii</i>
Baker's wild buckwheat	<i>Eriogonum arcuatum</i>		Kunth's penstemon	<i>Penstemon kunthii</i>
Orange wallflower	<i>Erysimum wheeleri</i>		Egg-leaf penstemon	<i>Penstemon ovatus</i>
Arrow-leaf buckwheat	<i>Eriogonum compositum</i>		Oak-leaf sumack	<i>Rhus trilobata</i>
Sulfur-flower buckwheat	<i>Eriogonum umbellatum</i>		Smooth sumac	<i>Rhus glabra</i>
Hairy false goldenaster	<i>Heterotheca villosa</i>		Alkali sacaton	<i>Sporobolus airoides</i>
Hot-rocks penstemon	<i>Penstemon deustus</i>		Snowberry	<i>Symphoricarpos oreophilus</i>

Table 3. List of 38 native plant species transferred to Native Roots, LLC and awaiting establishment at their seed production facility in Filer, ID.

Common Name	Species Name		Common Name	Species Name
Yarrow	<i>Achillea millefolium</i>		Phlox-flower penstemon	<i>Penstemon ambiguous</i>
Bubblegum mint	<i>Agastache cana</i>		Taper-leaf penstemon	<i>Penstemon attenuates</i>
Dwarf serviceberry	<i>Amelanchier alnifolia</i>		Beard-lip penstemon	<i>Penstemon barbatus</i>
Western red columbine	<i>Aquilegia formosa</i>		Shrubby penstemon	<i>Penstemon fruticosus</i>
Lavender-leaf sundrops	<i>Calylophus lavandulifolius</i>		Hall's penstemon	<i>Penstemon hallii</i>
Sundrops	<i>Calylophus serrulatus</i>		Idaho penstemon	<i>Penstemon idahoensis</i>
Rock clematis	<i>Clematis columbiana</i>		Toadflax penstemon	<i>Penstemon linarioides</i>
Tufted hairgrass	<i>Deschampsia caespitosa</i>		Broadleaf beardtongue	<i>Penstemon platyphyllus</i>
Silver rabbitbrush	<i>Ericameria nauseosa</i>		Sidebells penstemon	<i>Penstemon secundiflorus</i>
Cutleaf daisy	<i>Erigeron compositus</i>		Littlecup beardtongue	<i>Penstemon sepalulus</i>
Tall fleabane	<i>Erigeron elatior</i>		Venus penstemon	<i>Penstemon venustus</i>
Beautiful fleabane	<i>Erigeron formosissimus</i>		Syringa	<i>Philadelphus lewisii</i>
Buff fleabane	<i>Erigeron ochroleucus</i>		Salvia dorrii	<i>Purple sage</i>
Lacy buckwheat	<i>Eriogonum corymbosum</i>		Monro's globemallow	<i>Sphaeralcea munroana</i>
Douglas buckwheat	<i>Eriogonum douglasii</i>		Needle & threadgrass	<i>Stipa comata</i>
Snow buckwheat	<i>Eriogonum niveum</i>		Cushion Townsend daisy	<i>Townsendia montana</i>
Oval-leaf buckwheat	<i>Eriogonum ovalifolium</i>		Parry's Townsend daisy	<i>Townsendia parryi</i>
Short-fruit evening primrose	<i>Oenothera brachycarpa</i>		Rough mule's ear	<i>Wyethia scabra</i>
Tufted evening primrose	<i>Oenothera caespitosa</i>		Firechalice	<i>Zauschneria garrettii</i>

Expenditure Report

Over the period 2006 to 2015, ISDA has granted \$133,753 to the University of Idaho native plant domestication project. Annual grant and expenditures can be viewed in reports from past years. In 2015, \$14,000 was provided by ISDA for this on-going project. Due to conflicts over funding philosophy, the 2015 funding was not available until November and is being expensed late under a no-cost extension agreement.

<u>Category</u>	<u>Amount Allocated</u>	<u>Amount Expended</u>
Part-time wages and fringe benefits	\$ 8,750	\$ 484
Travel for collection, marketing activities	\$ 1,550	\$ 0
Seed, pots, trays, labels, soil mix, etc	\$ 2,000	\$ 2,000
Field charges, local motor pool, seed	\$ 1,700	\$ 1,700
Total funds allocated	\$14,000	
Total expended to date		\$ 4,184
Amount remaining as of Dec 1, 2015	\$ 9,816	